REMARKS

The claims have been amended to point out more particularly and distinctly claim the invention, and to distinguish structurally from the cited references.

This invention was based on an analysis showing that plastic damages due to mechanical shocks to electromagnetic transducers, commonly used in electroacoustic transducers such as receivers, are a complex result of the vector directions of the shocks. For example, a hearing aid having such a transducer may be dropped and strike the floor in any arbitrary direction with reference to the permanent magnetic flux, i.e., the operational direction of the armature in driving or transmitting force from an acoustical diaphragm. From this analysis the inventors not only discovered that snubbing in that particular direction only partially protects the armature from damage (page 2, lines 14-24), but they also provided novel and practical structures that more completely protect the armature, particularly from shocks in directions having significant components normal to that direction.

The cited references have the common object of snubbing the armature to limit its movements in the direction of the permanent flux field, that direction being the same as the direction of the armature's operational vibration. An obvious and generally recognized reason for snubbing in this direction is that plastic deformation of the armature away from its position of magnetic balance between the pole faces will directly affect its response to signal induced flux changes. Another reason for this direction of snubbing, as disclosed by the cited Carlson reference, is related to the form of the U-shaped armature of the reference.

> It has, however, been found that when the transducer is subject to high stress or sharp forces, the armature will be weak at the points where the armature has been formed or shaped in a bend. (Column 1, lines 47-50)

The alternative snubbing structures of Carlson, such as the elongated ridges 41 of coil encapsulant in Fig. 1, or the continuous ridges 41A of Fig. 2, or the flattened or rectangular ridges 41B of Fig. 3A, all face the flat sides of the armature reed 36. Therefore, they limit the extent of the movement of the armature reed only in the direction of its normal vibration, that is, the direction in which its strength has been weakened by stress concentration in the bends which form the U-shaped armature. With regard to the discussion at column 3, lines 6-11, this weakening is in fact only partially mitigated by forming the yoke 39 with the arcuate bend as described.

The Van Halteren et al reference is similar to Carlson in that it describes snubbers for limiting the extent of the deflection of the vibratory end of the armature leg in the same direction. The principal difference between the references is that Carlson provides snubbers within the coil tunnel and Van Halteren et al propose to provide snubbers at or near the free end of the armature.

Regarding the embodiment in Fig. 2 of Van Halteren et al, the description at column 3, lines 2-14 states that the rectangular wall portions 17a "have a height exceeding the thickness of the middle leg 11 of the E-shaped armature 13," and that the "portions 17a are at least partially located in the space between the two magnet elements 5, 7." The drawing is incomplete and does not fully support these statements, particularly because it omits the magnets and their location with reference to the other parts shown.

In any case the intended snubbing action limits only the proximity of the leg 11 to the face of either magnet in case of shocks. The snubbing action in the embodiment of Fig. 3 is similar in that the thickness of the wall portions 17b on the upper and lower sides of the piece 19b "determine the maximally possible deflection of the middle leg 11." (Column 3, lines 20-25.) This again results from the location of these wall portions between the magnet elements.

The embodiments in Figs. 4 and 5 of Van Halteren et al differ from the other embodiments in that snubbing is provided by an element 17c entirely located outside the space between the magnet elements. The snubbing surfaces are the sides 21 of the legs 23 of this element facing each other "so that the maximum deflection of the middle leg 11 can be limited by these sides 21." (Column 3, lines 32-37.) However, these embodiments are otherwise similar in function to the embodiments of Figs. 2 and 3.

In contrast to the references, the present invention recognizes and provides for the effects of shocks of external origin that tend to cause excursions of the armature in directions lying in its major plane and normal to the direction of the permanent magnetic flux. The snubber according to this invention is therefore oriented so that its surface has a predetermined clearance from the lateral edge of the armature. This feature is expressly set forth in the limitations of amended claim 1, and clearly distinguishes from the structures of the references, either alone or in combination.

It is submitted that the snubber of claim 1 is not obvious as a modification of either reference because the latter anticipate only shock induced movements of the armature in the direction in which it is intended to vibrate.

They do not anticipate or suggest the possibility or consequences of excessive and damaging shock-induced movements of the armature normal thereto, and they inherently provide no protection from such movements.

In addition to claim 1, claims 3, 5-7, 9 and 10 have been amended for clarity, and a new claim 11 has been added.

Attached hereto is a marked-up version of the changes made to claims 1, 3, 5-7, 9 and 10 by the current amendment. The attached pages are captioned "Version with markings to show changes made."

For the foregoing reasons, and in view of the amendments made herewith, reconsideration of the application and allowance are respectfully solicited. We attach hereto our petition for extension for response within the first month, and our deposit account order for the corresponding fee.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

Claims 1, 3, 5-7, 9 and 10 have been amended as follows:

1. (amended) An electromagnetic transducer having, in combination,

permanent magnet means forming a flux field extending in a direction between opposing pole faces across a working gap,

an electrical signal coil,

an elongate armature supported at one end thereof, extending through said coil and having its other end extending into said gap, said other end being vibratory in said direction and ~~adapted for connection to a diaphragm~~ having surfaces respectively opposing said pole faces, said surfaces being joined by a lateral edge, and

a snubber ~~means~~ secured in relation to the permanent magnet means and having a snubbing surface ~~oriented to limit excursions~~ extending in said direction, said snubbing surface having a predetermined clearance from said lateral edge of the armature normal to said direction.

3. (amended) A transducer according to claim 1, wherein the snubber ~~means~~ ~~comprise~~ comprises at least one filler piece ~~extending between said magnets~~ attached to the permanent magnet means in position to form said clearance.

5. (amended) A transducer according to claim 4, wherein the magnet strap forms a closed loop, the snubber ~~means~~ comprising two said filler pieces in facing relation secured to and within said loop.

6. (amended) A transducer according to claim 4, wherein the filler piece extends between the strap and sides of the magnets ~~unattached to the strap~~ for locating the magnets ~~thereon~~ within the strap when being attached thereto.

7. (amended) A transducer according to claim 1, wherein the snubber ~~means~~ ~~comprise~~ comprises a unitary member attached to the permanent magnet means and having spaced, mutually facing parallel snubbing surfaces with the armature extending therebetween.

9. A transducer according to claim 8, in which the unitary member has a ~~plastic~~ plastically deformable attachment to the magnet strap for preliminary rotational adjustment of said parallel surfaces about an axis normal to said direction.

10. A transducer according to claim 9, in which the unitary member has rigid attachments to the magnet strap in the ~~regions~~ vicinities of said parallel surfaces.

Claim 11 has been added.